of free-exciton line at 3.797 eV. Hall measurement was done to identify the p-type conduction. We will discuss as to whether or not the photoassisted technique can give rise to the p-type conductivity of ZnS:Na.

12:24
J13 6 **Explanation of the unique p-doping character of ZnTe.** Run-Di Hong, John D. Dow, Stefan Klemm, Shang Yuan Ren, M.-H. Tsai, and Robert V. Kasowski, *U. of Notre Dame* and E. I. du Pont de Nemours and Company* – An explanation is proposed for the fact that ZnTe is unique among the II-VI semiconductors in that it can be doped p-type rather easily. Native and foreign defects are shallow acceptors in ZnTe, while the corresponding defects are deep hole traps in other II-VI semiconductors. These defects undergo shallow-deep transitions as a function of increasing Se composition x in $ZnTe_{1-x}Se_x$ alloys. Tests of this proposal are suggested and the substitutional s- and p-bonded deep levels of ZnSe and ZnTe are predicted, extending the theory of Hjalmarson et al. [Phys. Rev. Lett. 44, 810 (1980)]. The possibility of doping ZnSe p-type with Be is also proposed and discussed. The mechanical stabilities of various dopants are determined by local density calculations using the pseudofunction method.

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12:36
J13 7 Magneto-Optics and Excitation Spectroscopy of Na-Acceptor-Bound Excitons in ZnSe. A. HOFFMANN, G. KUDLEK, R. HEITZ, N. PRESSER, J. GUTOWSKI, Inst. fur Festkorperphysik, Technische Universitat, Berlin, G. NEUMARK, Columbia University, New York, NY, and R. BHARGAVA, Philips Laboratories, Briarcliff Manor, NY -- At 2.7929 eV, a sharp zero-phonon luminescence doublet is observed in Na-doped ZnSe crystals[1], which can be attributed to the radiative decay of a Na-acceptor-bound exciton. The thermalization of the doublet and the occurrence of the higher-energy line as excitation resonance of the lower-energy component unambiguously show that both lines belong to the same impurity center. The term structure of this acceptor-exciton complex will be discussed on the basis of magneto-optics of the luminescence as well as of the excitation spectra. The development of nonlinearly increasing emission in the energy range of these transitions is analyzed for growing excitation densities.

[1] G.F. Neumark, Proc. 18th Int'l. Conf. on the Physics of Semiconductors, Stockholm 1986 (World Scientific 1987)

12:48
J13 8 Kinetics of Exciton Capture at Tellurium Isoelectronic Centers in δ-Doped ZnSe Quantum Wells--- DONGHAN LEE AT&T Bell Labs., Q. FU, A.V. NURMIKKO Brown U., R. GUNSHOR and M. KOBAYASHI, Purdue U. --- Time resolved photoluminescence spectroscopy has been applied to study the details of exciton capture and energy relaxation paths in ZnSe quantum wells in which planar doping by Te provides a nearly 2D distribution of isoelectronic centers [1]. The exciton capture is accompanied by very strong lattice relaxation effects, i.e. a sels-trapping process occurs. We have obtained direct insight to the self-trapping process by detailing the time-resolved spectra in terms of energy exchange and transfer between free exciton state and the principal self-trapped states, the latter corresponding to small Te clusters at the center plane of the quantum well. The results reinforce the interpretation of strong hole capture and reduction of its Bohr volume in the trapping process.

[1] Q. Fu et al, Phys. Rev. B39, 3173 (1989)

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13:00
J13 9 Transparent Conducting Semiconductor/Zinc Telluride Heterojunctions by MOCVD*. T.L. CHU, SHIRLEY S. CHU, J. BRITT, AND C. FEREKIDES, University of South Florida---ZnTe films have been deposited on glass substrates by MOCVD and photo-enhanced MOCVD using diethylzinc and diisopropyl telluride in a hydrogen atmosphere, and the effects of the composition of the reaction mixture investigated. The deposited films were characterized by scanning electron microscopy, x-ray crystallography, electron microprobe, optical transmission, resistivity, Hall, photovoltage, and photoluminescence measurements. All films are p-type, and their resistivity has been reduced from greater than $10^6$ ohm-cm to less than 20 ohm-cm by using arsine as a dopant during deposition. The properties of doped films were also characterized. ZnS and $Cd_xZn_{1-x}S$ ($x < 0.4$, Eg > 3.0 eV) films have also been deposited by MOCVD on glass and $SnO_2$-coated glass substrates as possible heterojunction partners for ZnTe. The incorporation of dopant into ZnS is difficult (lowest resistivity obtainable: about 5 X $10^4$ ohm-cm), and the addition of CdS to ZnS facilitates the doping process. ZnS/ZnTe and $Cd_xZn_{1-x}S$/ZnTe heterojunctions have been prepared by in-situ MOCVD, the junction properties will be discussed.
* Supported by Solar Energy Research Institute under Subcontract. Submitted by SWAMINATHA SUNDARAM.

13:12
J13 10 Ohmic Behavior of Au Contacts to p-type $Hg_{1-x}Cd_xTe$ with thin Interfacial layers. V. KRISHNAMURTHY, Stanford University, * A. SIMMONS, Texas Instruments Inc.; C.R. HELMS, Stanford University. *-- Invariably, ohmic contacts to either n or p-type II-VI materials are difficult due to Fermi level pinning. In this paper, we report on a structure that leads to non-rectifying behavior for p-type $Hg_{1-x}Cd_xTe$ that also shows promise for wide gap materials. This structure consists of a thin insulating layer interposed between the metal and semiconductor. This structure can reduce the surface state density and retard chemical reactions leading to ohmic behavior. In order to verify this hypothesis, thin plasma oxide layers grown on the $Hg_{1-x}Cd_xTe$ were then used in evaporated Au contacts. Reduced barrier heights were observed for the as-deposited plasma oxidized contacts. This behavior is attrbuted to a lower interface state density at the interfacial layer / $Hg_{1-x}Cd_xTe$ interface. In addition, a 100°C anneal promoted a further reduction in the interface state density and thereby yielded ohmic behavior. In comparison, as-deposited and annealed Au contacts without a thin interfacial layer were rectifying with a large barrier height. These results suggest that thin interfacial layers can be used to alter the barrier height resulting in ohmic contacts to p-type $Hg_{1-x}Cd_xTe$ when used with a high work function metal. A similar approach shows promise for wider gap materials.
* Supported by DARPA through NRL with subcontract 7482253 to Stanford University from Texas Instruments.

13:24
J13 11 Properties of Interface States at Grain Boundar[illegible] in Polycrystalline ZnO. J. F. CORDARO, J. C. SIMPSON, R. WINSTON, D. G. DiCARLO, New York State College of Ceramics, Alfred University* -- Electronic characteristics of interface states at grain boundaries in polycrystalline ZnO:M (M = Bi, Pr, Ba, or Nd) were observed. States near the interface Fermi level were examined from 300 K to 600 K using zero bias DLTS. Deep states close to the top of the valence band edge were studied by analyzing photocapacitance transients [illegible] 300 K to 400 K obtained using a monochromatic, chopped [illegible]